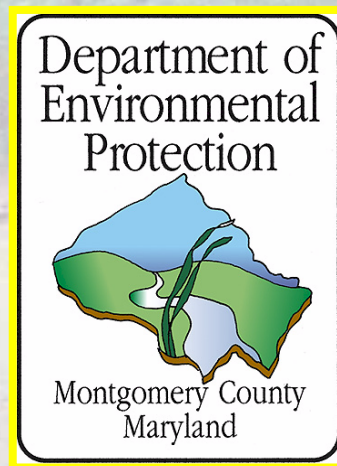


WATTS BRANCH WATERSHED RESTORATION STUDY

Task 1 Report

-MARCH 2003-



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Watts Branch Watershed Restoration Study

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TASK ONE – SUBWATERSHED ASSESSMENT AND PRIORITIZATION**1.1 INTRODUCTION****1.1.1. PURPOSE OF THE STUDY**

The Watts Branch Watershed Restoration Study is a watershed restoration plan being conducted by Montgomery County Department of Environmental Protection (MCDEP). The purpose of the study is to assess and prioritize potential stormwater management and stream enhancement projects that address channel erosion and riparian and aquatic resource conditions of the Watts Branch watershed. Results from this study will be used by MCDEP in an overall watershed plan to protect and improve conditions in the Watts Branch watershed. The watershed plan will include public outreach, capital projects, and volunteering opportunities. This Task One report summarizes existing conditions found in the watershed. In addition, the report discusses the methods used for identifying and prioritizing impaired subwatersheds and presents the results of this exercise. Task Two and Task Three reports will follow in the future containing specific projects, designs, prioritizations, and implementation recommendations.

This study is being conducted as a continuation of watershed management priorities stressed in the Countywide Stream Protection Strategy (CSPS), as well as to meet National and State permit requirements.

1.1.2 STUDY AREA

This study encompasses the Watts Branch watershed under Montgomery County jurisdiction, excluding the headwaters of Watts Branch, which are located in the City of Rockville. Information from the *Watts Branch Watershed Study* completed for the City of Rockville has been included in this report, but work within the city limits is outside of the scope of this study. The study area is divided into 10 major subwatersheds and 65 minor subwatersheds (see Figure 1.1).

The 22 square mile Watts Branch watershed located in southern Montgomery County in the vicinity of Rockville, North Potomac, and Travilah, is roughly bounded by Falls Road to the east, Travilah Road to the west, and River Road to the south. Watts Branch flows from its headwaters in the City of Rockville to the Potomac River, eventually reaching the Chesapeake Bay. This study examines the Watts Branch watershed from the Rockville city limits in the vicinity of Wootton Parkway to the junction with the Potomac River in the vicinity of Swains Lock.

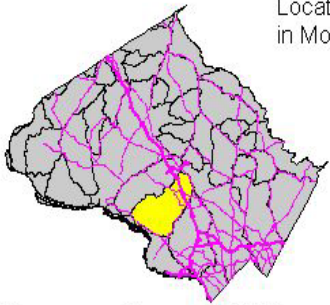
1.1.3 AGENCY COOPERATION AND STUDY TIMELINE

The Watts Branch Watershed Restoration Study is being conducted for MCDEP by A. Morton Thomas and Associates, Inc. (Civil Engineer) and Biohabitats, Inc. (Ecological Restoration Design). Numerous entities have been involved in the Study process, these agencies include: Maryland National Capital Park & Planning Commission, Montgomery County Department of Permitting Services, City of Rockville, and Washington Suburban Sanitary Commission.

Figure 1.1

Watts Branch Sub-watersheds

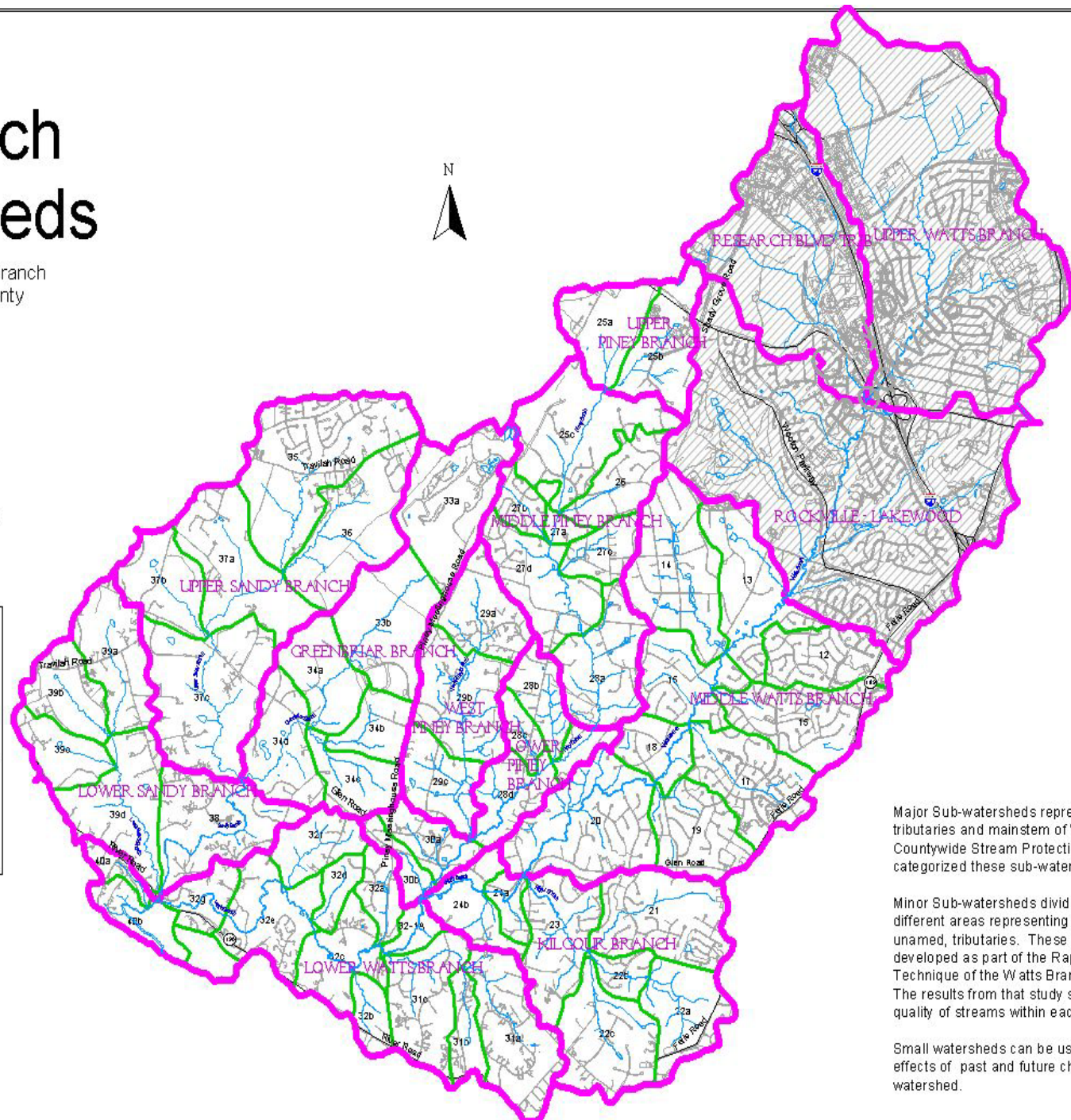
Location of Watts Branch
in Montgomery County



8500 0 3500 7000 Feet

LEGEND

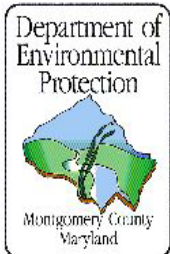
- Water Branch and Tributaries
- Major Sub-watersheds
- Minor Sub-watersheds
- Major Sub-watershed Name and Minor Sub-watershed Number
- Major Roads
- Minor Roads
- City of Rockville - Not Included in this study



Major Sub-watersheds represent the main tributaries and mainstem of Watts Branch. The Countywide Stream Protection Strategy (1996) categorized these sub-watersheds.

Minor Sub-watersheds divide Watts Branch into 65 different areas representing small, sometimes unnamed, tributaries. These sub-watersheds were developed as part of the Rapid Stream Assessment Technique of the Watts Branch Watershed (1998). The results from that study show environmental quality of streams within each subwatershed.

Small watersheds can be used to study specific effects of past and future changes in the watershed.



The timeline for the Task One Report of the Study is as follows:

March 2002	Review of Background Data and Reports
June 2002	Public Meeting
Fall 2002	Prioritization of Subwatersheds Established and Verified
Fall 2002	Subwatershed Prioritization Completed

1.2 EXISTING CONDITION OF THE WATERSHED

Watersheds are areas of land (bounded by topographic highpoints) that drain water, sediment and dissolved materials to a common outlet (Dunne and Leopold 1978). The condition and characteristics of a watershed are determined by several parameters, which include geology, topography, climate, land use, and biology. Of these parameters, land use is the most commonly modified characteristic of a watershed.

The 22 square mile Watts Branch watershed is located in the Potomac River basin drainage within the Piedmont physiographic province. The elevation of the Watts Branch basin is approximately 385 feet, with the highest elevation being 555 feet. Bedrock underlying most of Montgomery County consists of Late PreCambrian metasedimentary complexes. In the Watts Branch watershed specifically, the predominant rock type is the Upper Pelitic Schist Unit, consisting of albite-chlorite-muscovite-quartz schist with sporadic thin beds of laminated micaceous quartzite. The only notable exception occurs along the western perimeter of the watershed, where bedrock consists chiefly of serpentinite of the Early Paleozoic to Late Precambrian Ultramafic Rocks Complex (Maryland Geological Survey, 1968). Soils in the watershed are predominantly silt loams with the following five soil types represented in areas greater than 1000 acres: Brinklow (hydrologic soil group B), Chrome (C), Gaila (B), Glenelg (B), and Wheaton (B) series. The County receives approximately 40 inches of rainfall annually, with 22 inches falling during the growing season between April and September (Natural Resource Conservation Service, 1995).

Past studies indicate that over the last few decades, there has been a notable decline in water quality and the diversity of biological communities within the Watts Branch watershed. In large part, the decline in environmental quality and health of the Watts Branch watershed can be attributed to the past agricultural and current urban land use over the past 50 years. In fact, much of our current understanding of watersheds and the impacts of urbanization stems from research conducted in the Watts Branch watershed. In 1952, Dr. Luna Leopold established detailed measurements of headwater streams within the City of Rockville limits. Over a 20-year period of study, Leopold maintained a continuous record of physical changes in the channel shape and size. The findings indicated that the channel enlarged as the watershed developed. The changes were caused by increased frequency of high flow events as a result of runoff from impervious surfaces (Leopold 1994).

1.2.1 LAND USE AND IMPERVIOUSNESS

Our landscape is constantly altered by human activities. These activities include the clearing of forests, and the development of pervious areas into impervious surfaces. With these alterations in land use, hydrologic conditions within the watershed are changed, and the balance of rain water that percolates into the soil to recharge the groundwater, or evaporates and transpires through the trees and plants, is unbalanced. The disturbance to this balance may result in the

lowering of the water table, excessive flooding, stream erosion, sedimentation, poor water quality, loss of terrestrial and aquatic habitats and degraded biodiversity.

The Watts Branch watershed is nearly fully developed and consists of residential land uses with pockets of high density commercial, and research and development centers. Most of the streams within the Watts Branch watershed flow through a narrow, forested, riparian parkland corridor which is interspersed with residential, commercial, transportation (including Interstate 270), and recreational uses. The City of Rockville is situated at the headwaters of Watts Branch, while the I-270 corridor traverses the upper western section of the watershed. The Watts Branch watershed outside of the City of Rockville is primarily composed of large lot residential properties of the following proportion and sizes:

58%	2-acre residential lots
13%	1-acre residential lots
19%	0.5-acre residential lots
6%	Residential lots less than 0.5 acre
3%	Industrial uses

The watershed consists of approximately 7.5% parkland, as determined by property ownership (properties owned by M-NCPPC and Montgomery County). Additional open land exists by may be developed in the future.

One measure used to determine the health of a watershed is the percentage of impervious area. Impervious area is land covered by a surface that does not allow water to infiltrate into the soil, such as roads, parking lots, buildings, sidewalks. As trees are removed and hard impermeable surfaces are constructed, a higher proportion of precipitation leaves the watershed as runoff. Since streams form over decades and centuries, the cross section and shape of the channel must adjust to accommodate the more frequently experienced storm flows caused by this runoff. Stormwater runoff from developed areas frequently carries higher pollutant loads from streets and lawns. The cumulative effect is poor water quality and degraded biodiversity for both terrestrial and aquatic organisms. In time, stream channels adjust to the altered flow regime caused by urbanization, but rarely are the conditions favorable to allow the previous biotic community to return. Studies have shown that stream health (measured by channel stability, aquatic insect diversity and fish diversity) may become impaired when 10% to 12% of the watershed area is impervious (Schueler and Holland 2000). With modern stormwater management techniques, stream impacts are mitigated to some degree.

In the Watts Branch watershed, 33 of the 62 subwatersheds are greater than 10% impervious (see Figure 1.2). The methodology for calculating the imperviousness is described in Appendix A.

1.2.2 WATERSHED ASSESSMENTS

Since Dr. Leopold's study in the 1950's, the Watts Branch watershed has been the subject of innumerable investigations. These assessments were reviewed as part of this Watts Branch Watershed Restoration Study to establish the areas where the need for stream restoration and stormwater controls are the greatest (see Table 1).

The assessments cover a wide range of indicators of environmental quality. Among the parameters studied were:

- Channel shape
- Fish and Benthic Indices of Biological Integrity
- Nitrogen and phosphate loading
- Riparian buffer conditions
- In-stream habitat
- Imperviousness
- Sedimentation
- Water quality
- Human pathogens

Table 1. Assessments of the Watts Branch Watershed

1953-1999	Luna Leopold's channel geomorphology studies
1975	<i>Watts Branch Storm Water Management Study</i> (MCDEP)
1994	Maryland Biological Stream Survey (MdDNR)
1995-2002	<i>Special Protection Area Annual Reports</i>
1998	<i>Countywide Stream Protection Strategy</i> (MCDEP)
1998	<i>Rapid Stream Assessment Technique of the Watts Branch Watershed</i> (MCDEP)
1998	<i>Watts Branch Watershed Study</i> (MCDEP)
1998	<i>Environmental Resources Inventory, Potomac Subregion</i> (M-NCPPC)
1999	<i>Special Protection Area Conservation Plan for Piney Branch</i> (MCDEP)
1999	<i>Life Sciences Center Preliminary Water Quality Plan</i> (MCDEP)
2001	City of Rockville, <i>Watts Branch Watershed Restoration Study</i> (City of Rockville)
2002	<i>Source Water Assessments for Maryland Plants: Washington Suburban Sanitary Commission Potomac Water Filtration Plant</i> (WSSC)
2002	MCDEP Monitoring of Watts Branch

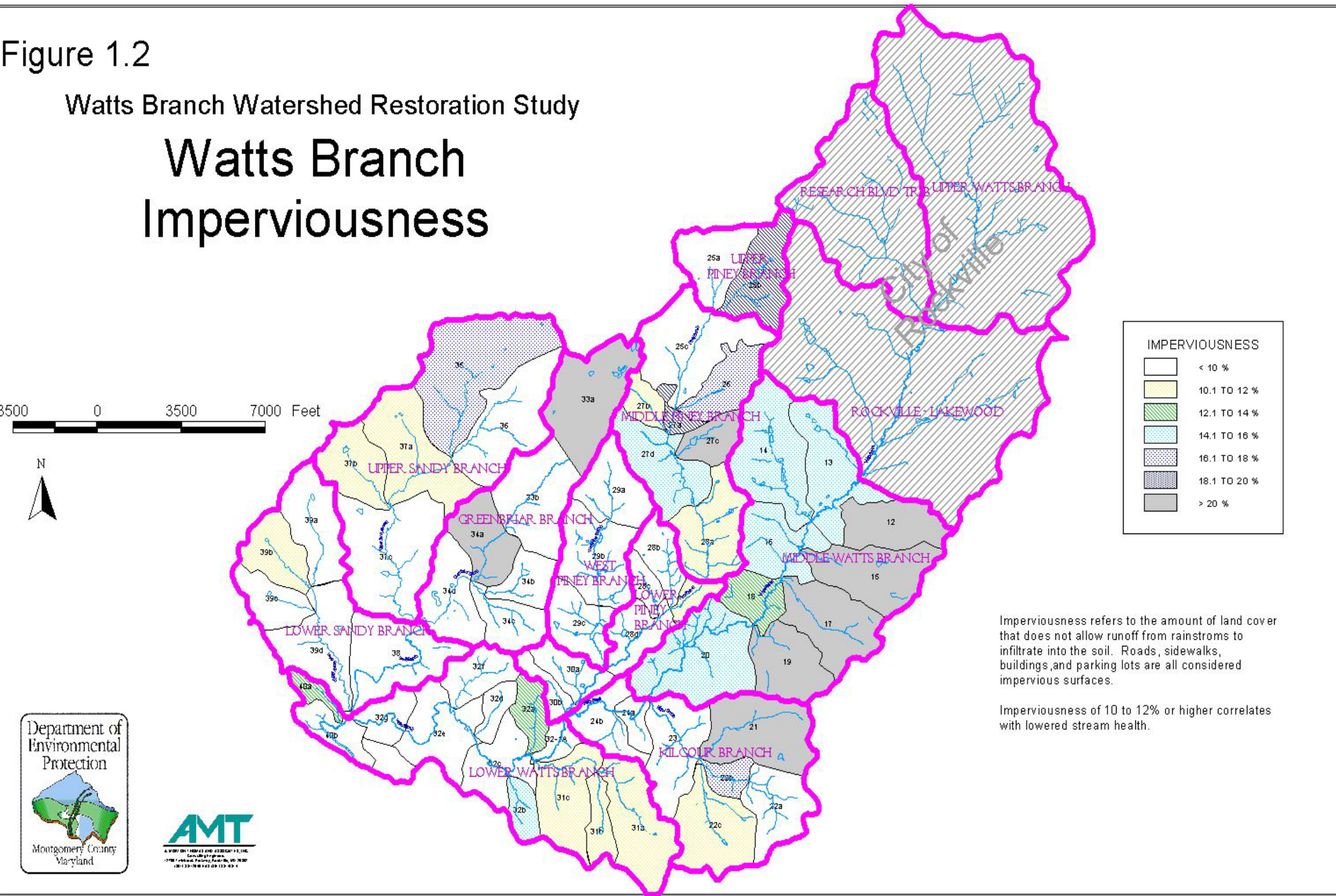
In the decades preceding the 1950s, the Watts Branch watershed was largely utilized for agriculture. There exists no data or studies prior to that time of watershed health, but it is likely that the conversion of the land use from forest to crops and pasture impacted stream stability as well as the biotic community within the drainage basin. Based on studies of other watersheds, the deleterious effects of agriculture to water quality and stream integrity are now well understood. Though the transition to agriculture and the later urbanization have both resulted in massive changes to the watershed, the long term effects of agriculture are not as damaging as the long term effects of dense urbanization. By the time Leopold began his study of Watts Branch, land use within the watershed was undergoing a dramatic transformation that has steadily continued through today. Despite the rare historical glance afforded by Leopold regarding stream channel dimensions, the ecological condition of the streams within Watts Branch were not assessed until the 1990's.

Public interest in the environment, combined with concern to protect and monitor ecological resources of Montgomery County culminated in the production of the *Countywide Stream Protection Strategy* (CSPS). The MCDEP, with assistance from various government agencies, initiated a general document to compile and assess the stream conditions of Montgomery

Figure 1.2

Watts Branch Watershed Restoration Study

Watts Branch Imperviousness



County. This document reviewed stream quality at the subwatershed level, with Watts Branch having 13 subwatersheds, including those within the City of Rockville. A prioritization system was then developed using the IBI scores, habitat condition, and land use characteristics of each subwatershed to develop stream condition prioritizations and management categories (see Figure 1.3). In Watts Branch the CSPA subwatershed conditions ranged from fair to poor condition. The CSPA also placed Watts Branch subwatersheds in various management categories including restoration areas, and watershed protection areas.

The monitoring data used in the CSPA was derived from data used to create the Watts Branch Watershed Study (MCDEP, 1998). This report was a more detailed analysis of the monitoring data collected in Watts Branch, which concludes that a majority of the stream channels are over-widened and entrenched, and that riffle habitat impairment is a concern (MCDEP, 1998).

The CSPA found the resource conditions to be good in the upper and western tributaries of Piney Branch and the Lower Sandy Branch. Conditions are fair throughout the rest of Watts Branch. This fair condition in the more urban areas of the watershed reflects the observed flow problems stemming from uncontrolled runoff. Although rated as fair, Lower Watts Branch supports a fish community of approximately 25 species. Many of the more tolerant species are well represented, although some sensitive fish species are found in fewer numbers. Smallmouth Bass are found in many of the pools in Watts Branch and colorful Greenside Darters can be observed in the rocky bottom runs (MCDEP1998).

The CSPA notes the exceptional quality of resources found in the Piney Branch subwatershed. The high water quality and cool steady baseflow found in this tributary are important to maintaining conditions downstream in the main stem. This fragile tributary has a relatively small channel and is particularly sensitive to flow conditions, with very little assimilative capacity to deal with impacts. Recognizing the need to protect this healthy resource, the subwatershed was designated as a Special Protection Area (SPA) in 1995. Chapter 19, Article V of the Montgomery County Code requires that all SPAs must have a conservation plan to maintain and improve resource conditions as the subwatershed is developed (MCDEP, 1998).

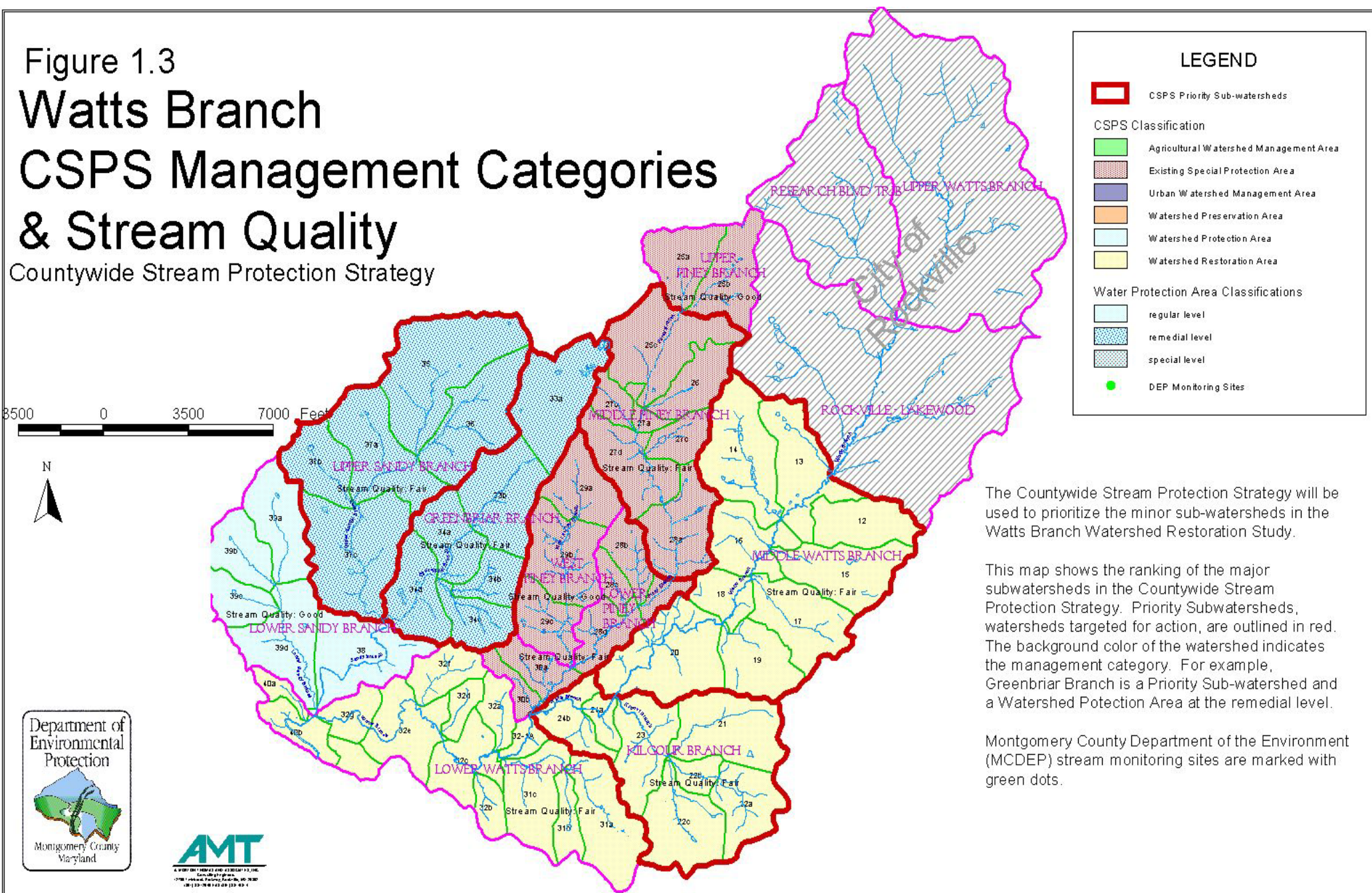
In 1999, the MCDEP developed and published the *Special Protection Area Conservation Plan for Piney Branch* (MCDEP 1999). The *Conservation Plan* presents baseline data and water quality goals for the Piney Branch Special Protection Area (SPA), which is 3.75 square miles of drainage area within the Watts Branch watershed. The document outlines performance goals for future development projects within the Piney Branch watershed.

The Special Protection Area Program Annual Report 2001, is a synopsis of monitoring data collected in all SPA's of Montgomery County, including the Piney Branch SPA. The report notes downward trends for numerous monitoring parameters in Piney Branch. The report also specifically notes a potential nutrient input problem in the subwatershed due to the accelerated algal growth in the streams. The exact sources to this problem have not been identified, but will be closely investigated through future monitoring. Pathways for nutrients entering the stream system include the following: 1) overland runoff carrying fertilizers, 2) groundwater delivering surface fertilizers through saturation, 3) domestic and wild animal waste, 4) discharged sediments from control ponds (MCDEP, 2002).

The assessments discussed above conclude that the Watts Branch watershed continues to experience stream channel degradation and impaired water quality as a result of urbanization.

Figure 1.3 Watts Branch CSPS Management Categories & Stream Quality

Countywide Stream Protection Strategy



The Countywide Stream Protection Strategy will be used to prioritize the minor sub-watersheds in the Watts Branch Watershed Restoration Study.

This map shows the ranking of the major subwatersheds in the Countywide Stream Protection Strategy. Priority Subwatersheds, watersheds targeted for action, are outlined in red. The background color of the watershed indicates the management category. For example, Greenbriar Branch is a Priority Sub-watershed and a Watershed Protection Area at the remedial level.

Montgomery County Department of the Environment (MCDEP) stream monitoring sites are marked with green dots.

The *CSPS*, including regular DEP monitoring, provides a clearer understanding of the range of environmental resources and the degree to which impacts have occurred spatially throughout the watershed by dividing the watershed into subwatersheds. However, the size of the subwatersheds delineated in the *CSPS* are geographically large areas. Although a subwatershed may be ranked in fair condition, the scale of the study may not capture the smaller stream reaches within the subwatershed that have shown resiliency. The *CSPS* for the Watts Branch watershed is therefore a broad assessment of the existing resource conditions and identifies the general areas in greatest need of further evaluation and possible restoration.

To fully assess the condition of streams within the Watts Branch watershed, Maryland National Capital Park and Planning Commission (M-NCPPC) and the MCDEP contracted Biohabitats, Inc. in 1997 to assess the overall health and condition of all streams within the Watts Branch watershed, excluding the streams within the City of Rockville. The assessment of the Watts Branch watershed employed the Rapid Stream Assessment Technique (RSAT) developed by the Metropolitan Washington Council of Governments (MWCOCG). This technique employs an integrated numerical scoring approach to evaluate the major physical, biological, and chemical parameters that determine overall stream quality. Some of the physical parameters evaluated include stream width, depth, embeddedness, substrate fouling, bank height and riparian conditions. In addition, biological and chemical water quality conditions were assessed including water temperature, pH, conductivity, total dissolved solids, dissolved oxygen, turbidity, and macroinvertebrate communities (Biohabitats, Inc. 1998).

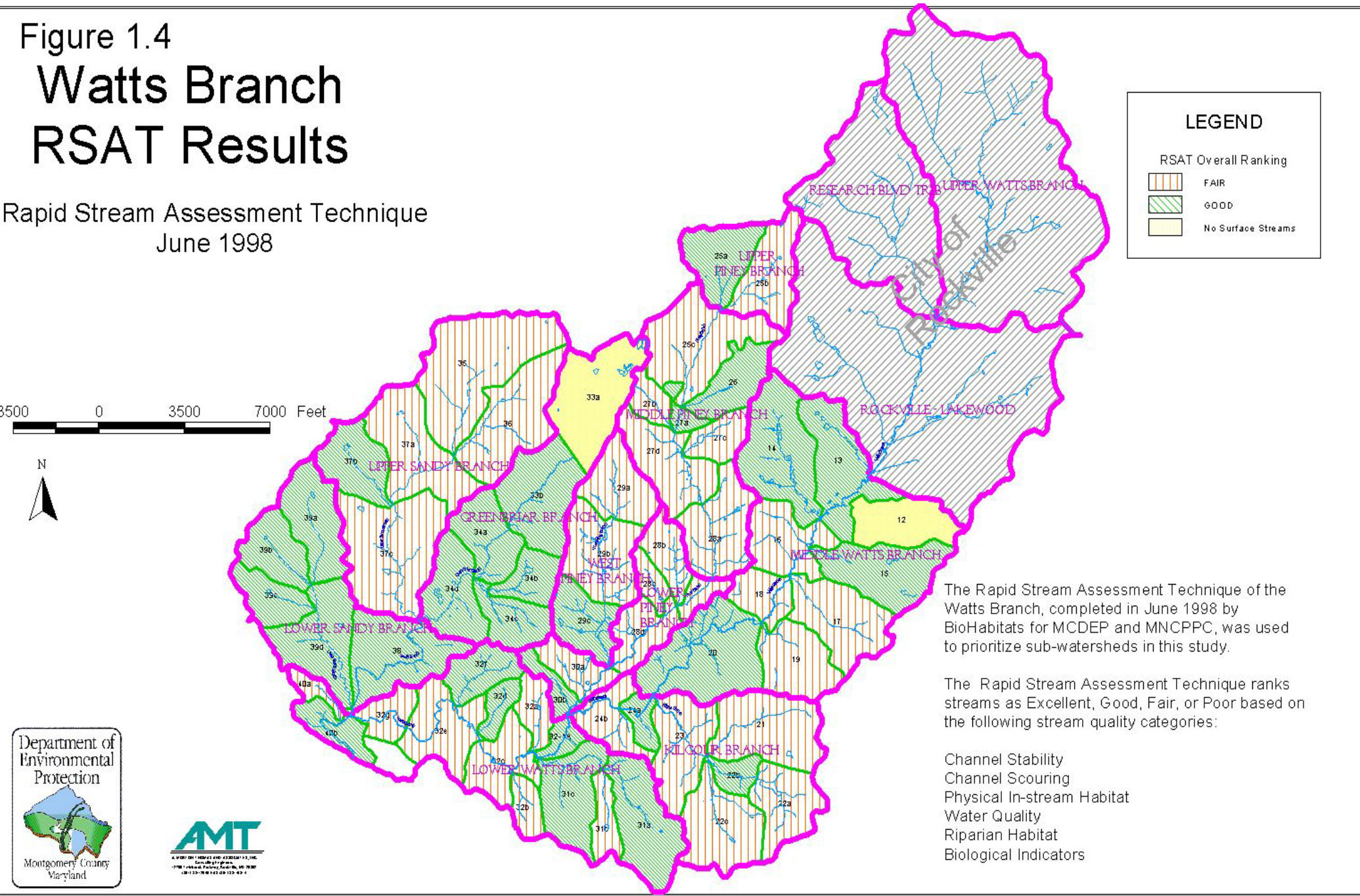
For the purposes of the RSAT assessment, the Watts Branch Watershed was divided into 28 subwatersheds. Each watershed was assigned an individual identification number ranging from 13 through 40. The RSAT analysis was performed on the 58 miles of stream channel within the study area at a frequency of ten-cross sections per mile. The RSAT transects were averaged by subwatershed and therefore do not fully reflect the resolution of the study. Scores ranged from 19 to 36 with higher scores indicating better stream health. All subwatersheds were categorized as either good or fair, with no catchments in excellent or poor condition (see Figure 1.4).

The results of the RSAT survey indicate that the entire Watts Branch watershed has experienced slight to moderate levels of degradation with areas of high erosion and channel instability. Tributaries with low density development such as in Stoney Creek and Greenbriar Branch were consistently found to have “Good” scores. Tributaries in the more developed eastern edge of the study area were found to be “Fair”. The study made no recommendations as to solutions for restoring degraded subwatersheds. However, the value of the RSAT data collected at the transect level was stressed as a powerful insight into stream reaches that may be in greatest need of attention.

The Watts Branch watershed has received considerable attention, particularly over the last decade, as interest in the environment has grown. Recently, the *Watts Branch Watershed Study* (2001), was conducted for the City of Rockville to assess watershed conditions, to identify potential stormwater retrofit and stream restoration opportunities, and to make recommendations for watershed rehabilitation. The headwaters of the Watts Branch main stem are located in the City of Rockville; therefore, stormwater controls that are implemented in the City of Rockville will benefit the quantity and quality of water downstream.

Figure 1.4 Watts Branch RSAT Results

Rapid Stream Assessment Technique
June 1998



The Rapid Stream Assessment Technique of the Watts Branch, completed in June 1998 by BioHabitats for MCDEP and MNCPPC, was used to prioritize sub-watersheds in this study.

The Rapid Stream Assessment Technique ranks streams as Excellent, Good, Fair, or Poor based on the following stream quality categories:

- Channel Stability
- Channel Scouring
- Physical In-stream Habitat
- Water Quality
- Riparian Habitat
- Biological Indicators

The Maryland Department of the Environment (MDE) and the Washington Suburban Sanitary Commission (WSSC) recently conducted a source water assessment for the Potomac Water Filtration Plant. This WSSC facility is located on the Potomac River immediately downstream of Watts Branch. The *Source Water Assessments for Maryland Plants: Washington Suburban Sanitary Commission Potomac Water Filtration Plant*, performed in accordance with the 1996 Safe Drinking Water Act, identified potential water contaminants and their sources, and made recommendations for improving the water sources. Watts Branch was explicitly studied due to the proximity of its outlet to the filtration plant. In the *Source Water Assessment*, a geomorphic evaluation of the Watts Branch main stem was performed to analyze the extent and persistence of streambed erosion and suspended solids loadings. Eight stations were examined, none of which were found to be stable. The results of the geomorphic study indicate that Watts Branch is in a transitional state that is most likely associated with the impervious cover throughout the watershed (Becker and O'Melia, LLC 2002).

1.2.3 CURRENT STORMWATER MANAGEMENT

Much of the Watts Branch watershed consists of residential lots of 2 acres or greater. Currently, development of lots of this size do not require stormwater management as it is assumed that the amount of impervious area would be low. On July 1, 2003, the requirements for this regulation change, and development of all lot sizes in Montgomery County will have to address stormwater management.

In facilities providing quantity control only, stormwater runoff is controlled by stormwater management (SWM) ponds. SWM ponds are designed to release stormwater into local streams at a rate equal or less than the rate before development occurred. These facilities are generally older and were not designed to meet water quality control concerns such as reducing the amount of sediment and pollutants released into streams. These facilities could be retrofitted to provide quality control. Some stormwater management facilities that were are designed to improve the water quality (eg. sand filter) do not provide quantity control. Stormwater management facilities that were designed to provide both water quality and water quantity control represent the most modern methods of control.

The Watts Branch watershed contains 25 stormwater management facilities that control a drainage area of greater than 25 acres and numerous facilities that treat smaller drainage areas. The areas of the watershed with the greatest density of development are Upper Sandy Branch, Upper and Middle Piney Branch, Middle Watts Branch and Kilgour Branch. Upper Sandy Branch and Piney Branch have the newest stormwater management facilities that are designed to control both quantity and quality. In Middle Watts Branch and part of Kilgour Branch are older, higher density neighborhoods along the main stem of Watts Branch, north of Glen Road and west of Falls Road are either without stormwater controls or with quantity control only.

Figure 1.5 designates areas with stormwater management, areas where stormwater controls are not provided, and areas where these controls are not required prior to July, 2003.

Figure 1.5

Watts Branch Stormwater Management



1.3 SUBWATERSHED PRIORITIZATION

The intent of the Watts Branch Watershed Study is to identify and prioritize subwatersheds in need of hydrologic rehabilitation and ecological restoration. Existing conditions within the 22 square mile watershed have largely been assessed in previous studies. In order to identify the subwatersheds in greatest need of rehabilitation efforts, a method was developed to rank and prioritize each subwatershed using geographic information and data gathered in previous studies of the Watts Branch watershed. Parameters were proposed for the prioritization system that met the following criteria: to describe existing stream stability, impacts to hydrology, quality of habitat, water quality, and health of aquatic biota. Additional criteria for the suitability of the parameters was that the information be readily available from recent watershed studies or county geographical information. The following prioritization parameters were initially considered: RSAT, CSPA Category, Percent Imperviousness, Percent Increase in Discharge, Percent Imperviousness Controlled by Stormwater Management, Percent Forest Cover, and Public Comments.

Parameters meeting the criteria were selected for the prioritization system and include: RSAT, CSPA Management Category, and the Percent Imperviousness. The other listed parameters were not used in the prioritization system, although much of this information will be gathered in future phases of study; public comments were not used as a prioritization parameter, but were cross-checked to assure any comment area was located in a prioritized subwatershed.

1.3.1 PRIORITIZATION PARAMETERS AND SCORING METHODOLOGY

Following the selection of the prioritization parameters, an initial scoring methodology was developed for each parameter. The goal of the scoring methodology was to weigh the prioritization parameters so that each subwatershed could be categorized accurately. A proposed methodology was developed and presented to interested citizens at a public meeting held June 20, 2002. This public meeting was also held to introduce the overall study design and schedule to the public including addressing comments, questions, and concerns.

The study was well received and with no additional modifications, Biohabitats and A. Morton Thomas prioritized the subwatersheds using a draft scoring methodology. Subwatersheds were evenly divided by rank into four categories; Excellent, Good, Fair, and Poor. Five subwatersheds from each of the four narrative categories were randomly selected to calibrate the prioritization system. Personnel from Biohabitats and MCDEP visited the 20 subwatersheds and assessed the condition of each using a field calibration sheet, included in Appendix A. Results from the field calibration sheet were compared to the subwatershed prioritization. The correlation was poor. The data was re-evaluation to determine if each parameter was properly weighted. The re-evaluation included comparing the field data sheets, which closely resemble parameters assessed in the RSAT, directly to the RSAT parameter of the prioritization system. The correlation was better. The field visits only allowed for a brief visit to the randomly selected subwatersheds from each category. Under such circumstances, it was only possible to visit a small stream segment in each subwatershed. The calibration stream segments were then compared to their corresponding RSAT transects, rather than the subwatershed average of the RSAT transects. As was expected, the results corresponded much better. Although the RSAT transects describe the watershed at the highest resolution available, it was felt prioritizing

between 520 individual stream segments was too fine for the watershed restoration study. The calibration exercise demonstrated that greater weight be placed on the RSAT scores.

The following discussion briefly describes the prioritization parameters and the scoring criterias used (Tables 2-5).

Rapid Stream Assessment Technique (RSAT) (Score Range 2-16)

RSAT Scores ranged from 19 to 36 (out of 40) with higher scores indicating better stream health. Prioritization scores for the RSAT prioritization parameter are shown in Table 2, where the higher the prioritization score, the greater the need for restoration. Note that the RSAT parameter holds the greatest weight in the stream prioritization because the assessment itself encompasses physical, biological and chemical parameters specific to each subwatershed.

Table 2 Prioritization scores using RSAT values from 1998 study of Watts Branch

<i>RSAT Values</i>	<i>Prioritization Score</i>
20 - 22	16
22.1 - 24	14
24.1 - 26	12
26.1 - 28	10
28.1 - 30	8
30.1 - 32	6
32.1 - 34	4
>34.1	2

CSPS Category (Score Range 1-6)

The Countywide Stream Protection Strategy (CSPS) rated the quality and health of streams at a broad scale throughout the County. The Watts Branch watershed was divided into 13 subwatersheds. Each subwatershed was ranked into one of the following CSPS Management Categories, listed in Table 3. The Prioritization Score places the greatest priority on the most impaired watersheds.

Table 3 Prioritization scores using CSPS Management Categories for Watts Branch

<i>CSPS Management Category</i>	<i>Prioritization Score</i>
Restoration Area	6
Remedial	4
Regular	3
SPA	1

Percent Imperviousness (Score Range 1-8)

The percent of impervious cover in a watershed has been found to be a strong indicator of stream health. Because much of the development in Montgomery County occurred prior to effective stormwater management controls, streams in highly developed watersheds are often found to be degraded both in physical structure as well as biological productivity and diversity. Streams found in watersheds with more than 10-12% imperviousness begin to show evidence of degradation, although presence of stormwater management can sustain stream health beyond the 10% threshold. Imperviousness for each subwatershed was determined using GIS information that was based upon aerial photos from 1993-1995 and was updated based on development since that time. Prioritization scores for the percent imperviousness prioritization parameter are shown in Table 4.

Table 4 Prioritization scores using percent imperviousness for Watts Branch

<i>% Imperviousness</i>	<i>Prioritization Score</i>
> 20%	8
18.1 – 20%	7
16.1 – 18%	6
14.1 – 16%	5
12.1 – 14%	4
10.1 – 12%	3
< 10%	1

The prioritization scores of each parameter were added for all of the subwatersheds. The lowest possible score, corresponding with a low priority subwatershed, is 4, while the highest possible score, corresponding with a high priority subwatershed, is 30.

Subwatersheds were scored into narrative prioritization categories. To develop the prioritization categories, the mean of all prioritization scores was calculated. The mean (equaling a total prioritization score of 15) was assumed to be an average subwatershed condition relative to all other subwatersheds. The standard deviation was calculated. By adding or subtracting standard deviations, the prioritization categories were made as follows in Table 5.

Table 5 Narrative Prioritization Categories determined from total prioritization score.

<i>Narrative Prioritization Category</i>	<i>Total Prioritization Score</i>
Degraded	26-30
Poor	21-25
Fair	16-20
Good	10-15
Excellent	4-9

1.3.2 PRIORITIZATION RESULTS

Figure 1.6 shows the prioritization category results for all subwatersheds. A spreadsheet showing these results is also provided in Appendix A. The final task was to select the highest priority subwatersheds. Therefore, only subwatersheds ranked as fair, poor or degraded were considered. Given the extensive area of these subwatersheds, additional effort was made to refine this list.

1.3.3 Prioritization Tiers

The general philosophy to watershed restoration is to begin with the headwater streams and work downstream. Greater consideration is also given to those subwatersheds which drain into watersheds ranked “Good” or “Excellent”, in order to maintain or improve these higher quality resources. A tier approach was developed as follows, in order of highest priority:

- Tier 1* - Degraded subwatersheds; and all fair or poor headwater subwatersheds flowing into good or excellent subwatersheds
- Tier 2* - Poor headwater subwatersheds
- Tier 3* - Fair headwater subwatersheds
- Tier 4* - Fair or poor 2nd order subwatersheds; and all remaining poor subwatersheds
- Tier 5* - Fair or poor mainstem Watts Branch subwatersheds
- Tier 6* - Alternatives

Preliminary tier scoring results are shown below.

Tier 1

- | | |
|---------------------------|---------------------|
| ▪ Potomac Green Tributary | ▪ Subwatershed 19 |
| ▪ Main Stem Watts Branch | ▪ Subwatershed 40 A |
| ▪ Piney Branch Headwaters | ▪ Subwatershed 25 B |
| ▪ Potomac View Branch | ▪ Subwatershed 31 B |
| ▪ Greenbriar Branch | ▪ Subwatershed 34 A |
| ▪ Main Stem Sandy Branch | ▪ Subwatershed 37 A |
| ▪ Piney Glen Tributary | ▪ Subwatershed 29 A |

Tier 2

- | | |
|----------------------------|---------------------|
| ▪ Kilgour Branch | ▪ Subwatershed 21 |
| ▪ Fallsreach Tributary | ▪ Subwatershed 17 |
| ▪ Kilgour Branch | ▪ Subwatershed 22 A |
| ▪ Cold Spring Tributary | ▪ Subwatershed 15 |
| ▪ Main Stem Watts Branch | ▪ Subwatershed 32a |
| ▪ Main Stem Watts Branch** | ▪ Subwatershed 16 |
| ▪ Main Stem Watts Branch | ▪ Subwatershed 32b |

Tier 3

- | | |
|----------------------------|---------------------|
| ▪ Sandy Branch Headwaters | ▪ Subwatershed 35 |
| ▪ Kilgour Branch | ▪ Subwatershed 22 C |
| ▪ Main Stem Watts Branch** | ▪ Subwatershed 13 |
| ▪ Valley Drive Tributary | ▪ Subwatershed 14 |
| ▪ Upper Piney Branch | ▪ Subwatershed 27 C |

Tier 4

- | | |
|---------------------------|---------------------|
| ▪ Main Stem Watts Branch | ▪ Subwatershed 18 |
| ▪ Main Stem Watts Branch* | ▪ Subwatershed 16 |
| ▪ Kilgour Branch | ▪ Subwatershed 22 B |
| ▪ Kilgour Branch | ▪ Subwatershed 23 |

Tier 5

- | | |
|---------------------------|--------------------|
| ▪ Main Stem Watts Branch | ▪ Subwatershed 18 |
| ▪ Main Stem Watts Branch | ▪ Subwatershed 32c |
| ▪ Main Stem Watts Branch | ▪ Subwatershed 20 |
| ▪ Main Stem Watts Branch* | ▪ Subwatershed 13 |
| ▪ Main Stem Watts Branch | ▪ Subwatershed 32e |
| ▪ Main Stem Watts Branch | ▪ Subwatershed 32g |

**Headwater part of subshed only

*Mainstem part of subshed only

A final screening of the subwatersheds was conducted to identify subwatersheds where restoration would be inappropriate. One criteria for this final screening was excluding subwatersheds where there has been a large proportion of recent development or where development is not complete, yet anticipated in the near future. It was felt that these subwatersheds are not ideal for restoration since the drainage basin will experience continued disturbances. Subwatersheds eliminated due to this circumstance are as follows: 25B, 32A, 32B, 35, 34A, 37A, 29A. Finally, each subwatershed identified in the preliminary tier prioritization and not excluded due to continued development was visited by MCDEP to provide a last level of suitability. The final tier assignments are shown below, and further described in Appendix A which includes notes explaining changes made as a result of the field visits by MCDEP (elimination of subwatershed 31B). The subwatersheds identified in the final tier assignment (starting with Tier 1 assigned subwatersheds) will be considered and further evaluated in Task 2 and Task 3 as potential areas for stormwater management retrofit and stream valley restoration projects.

Tier 1

- | | |
|--------------------------|---------------------|
| ▪ Main Stem Watts Branch | - Subwatershed 40 A |
| ▪ Upper Piney Branch | - Subwatershed 27 D |

Tier 2

- | | |
|----------------------------|---------------------|
| ▪ Kilgour Branch | - Subwatershed 21 |
| ▪ Fallsreach Tributary | - Subwatershed 17 |
| ▪ Kilgour Branch | - Subwatershed 22 A |
| ▪ Cold Spring Tributary | - Subwatershed 15 |
| ▪ Main Stem Watts Branch** | - Subwatershed 16 |

Tier 3

- | | |
|----------------------------|---------------------|
| ▪ Kilgour Branch | - Subwatershed 22 C |
| ▪ Main Stem Watts Branch** | - Subwatershed 13 |
| ▪ Upper Piney Branch | - Subwatershed 27 C |
| ▪ Valley Drive Tributary | - Subwatershed 14 |

Tier 4

- | | |
|---------------------------|---------------------|
| ▪ Main Stem Watts Branch* | - Subwatershed 16 |
| ▪ Kilgour Branch | - Subwatershed 22 B |
| ▪ Kilgour Branch | - Subwatershed 23 |

Tier 5

- | | |
|---------------------------|-------------------|
| ▪ Main Stem Watts Branch | - Subwatershed 18 |
| ▪ Main Stem Watts Branch | - Subwatershed 20 |
| ▪ Main Stem Watts Branch* | - Subwatershed 13 |

Tier 6

- | | |
|--------------------------|---------------------|
| ▪ Main Stem Watts Branch | - Subwatershed 32 E |
| ▪ Main Stem Watts Branch | - Subwatershed 32 G |
| ▪ Main Stem Watts Branch | - Subwatershed 32 C |

**Headwater part of subshed only

*Mainstem part of subshed only

Watts Branch Subwatershed Prioritizations



References

Watts Branch Watershed Restoration Study

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APPENDIX A

IMPERVIOUS CALCULATIONS

The imperviousness was initially calculated using the Land Cover GIS data from 1993-95 photogrammetry. This contains polygons of buildings, parking lots, roads, sidewalks, woodland, cropland, pastures and open space, but does not include driveways or roadside sidewalks. (The landcov.shp file was used.)

The Building shapefile given by the county included some buildings not included in the landcov files. Additional buildings present in subwatersheds 25b, 25c, 26, 27a, 27b, and 27d were added to the impervious area.

The property files were examined. Properties that appeared to be subdivided for building but that did not contain a building were identified. These areas were summed by zoning code. Areas zoned as RE2 were considered 12% impervious (based on TR-55). Zone RE1 was considered 20% impervious (based on TR-55). Areas zoned R200 (approx 0.5 acre lots) are assumed 25% impervious by TR-55. However data from recent development in the Watts Branch watershed show that for lots zoned R200, the impervious area (comprised of the building footprint and the driveway) averaged 28%. Therefore, R200 lots were assumed to be 28% impervious.

The land cover files do not include driveways for most properties. Average driveway lengths for subsheds were found and the number of buildings without driveways shown was calculated. Assume for driveways greater than or equal to 100' long a 14' width except for last the 50' where a 28' width is assumed. For driveways less than 100', assume a 10' width except the last 30' where a 20' width is assumed. Sidewalks were assumed to exist in the denser neighborhoods of subwatersheds 13, 15, 16, 17, 18, 19, 20, 21, 23, and 35. The road lengths in the neighborhoods were measured; four foot wide sidewalks were assumed to be on both sides of the road.

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